CLAIMS:

1. An auditory prosthesis device for selectively stimulating electrodes within an auditory prosthesis electrode array, comprising:

a transducer for converting a complex acoustic sound into an electrical signal,

signal processing means responsive to an electrical signal and generating a temporal pattern of stimulation pulses to selected electrodes within the electrode array, the stimulation pulses being applied to each electrode at an electrode stimulation rate,

feature extraction means for deriving an estimate of at least one fundamental frequency of the electrical signal, and

stimulation pulse adjustment means for adjusting the stimulation pulses in accordance with the estimated fundamental frequency.

2. An auditory prosthesis device according to claim 1, wherein;

the feature extraction means comprises a plurality of fundamental frequency templates separating the electrical signal into a plurality of different frequency components, each template comprising a first template filter centred on a first frequency and one or more further template filters centred on harmonics of that first frequency, and wherein

the stimulation pulse adjustment means act to compare output signals from the template filters in each template to determine a matching template passing maximum power compared to the remaining templates, the first frequency of the matching template being used by the stimulation pulse adjustment means as the estimated fundamental frequency.

3. An auditory prosthesis device according to claim 2, wherein the stimulation pulse adjustment means selectively generates stimulation pulses during an electric stimulation period, the pulse adjustment means acting to convert the estimated fundamental frequency into the electric stimulation period using a specific conversion function.

4. An auditory prosthesis device according to claim 3, wherein the specific conversion function performs a first function of setting the longest interval between consecutive pulses

in the temporal pattern during the electric stimulation period in accordance with the estimated fundamental frequency.

5. An auditory prosthesis device according to claim 4, wherein the specific conversion function performs a second function of setting the electric stimulation period in accordance with the estimated fundamental frequency.

6. An auditory prosthesis device according to claims 4 and 5, wherein the specific conversion function varies between performing the first and second function.

7. An auditory prosthesis device according to claims 4 and 5, wherein the specific conversion function preferentially performs the second function when the electrodes to be stimulated in the temporal pattern are physically proximate each other.

8. An auditory prosthesis device according to claim 2, wherein, in the presence of two or more complex acoustic sounds, the feature extraction means derive an estimate of multiple fundamental frequencies from the electrical signal and the specific conversion function converts the multiple fundamental frequencies into a corresponding number of interleaved electric stimulation periods.

9. An auditory prosthesis device according to claim 1, wherein the stimulation pulse adjustment means modulate the amplitude of the stimulation pulses applied to all or a subset of activated electrodes with a modulation rate corresponding to the estimated fundamental frequency.

10. An auditory prosthesis device according to claim 1, wherein the stimulation pulse adjustment means to process the output signals from the template filters in the matching template to determine an estimate of one or more formants of the electrical signal.

11. An auditory prosthesis device according to claim 1, wherein the stimulation pulse adjustment means modulate the amplitude of the stimulation pulses applied to one or more electrodes within the electrode array which correspond to the estimated one or more

formants.

12. An auditory prosthesis device according to claim 1, wherein, when the feature extraction means derives an estimate of multiple fundamental frequencies, each corresponding to a different complex acoustic sound, from the electrical signal, the stimulation pulse adjustment means temporally segregate the amplitude modulation applied to the stimulation pulses for each different complex acoustic sound.

13. An auditory prosthesis device according to claim 1, wherein the stimulation pulse adjustment means act to apply a temporal offset to the stimulation pulses applied to those electrodes within the electrode array which correspond to harmonic components or formant frequencies of the acoustic signal with respect to the stimulation pulses applied to other electrodes in the electrode array.

14. An auditory prosthesis device according to claim 13, wherein the stimulation pulses are applied simultaneously to those electrodes within the electrode array which correspond to harmonic components or formant frequencies of the acoustic signal.

15. An auditory prosthesis device according to claims 1, wherein the stimulation pulses applied to those electrodes within the electrode array which correspond to harmonic components or formant frequencies of the acoustic signal are temporally segregated from the stimulation pulses applied to the other electrodes in the electrode array.

16. A bilateral auditory prosthesis apparatus including two auditory prosthesis devices according to claim 1.

17. A bilateral auditory prosthesis apparatus according to claim 16, wherein the stimulation pulse adjustment means of a first of the auditory prosthesis devices act to determine a matching template passing maximum power compared to the remaining templates in the first auditory prosthesis device, the first auditory prosthesis device further acting to determine the power passed by the corresponding template in the second auditory prosthesis device and, if less than the power passed by the matching template in the first

auditory prosthesis device, adjusting the stimulation pulses in the first auditory prosthesis device in accordance with the estimated fundamental frequency.

18. A bilateral auditory prosthesis apparatus according to either one of claims 16 or 17, wherein, in the presence of two complex acoustic sounds, the stimulation pulse adjustment means of the first auditory prosthesis device act to determine to matching templates passing power maxima compared to the remaining templates in the first auditory prosthesis device, the stimulation pulse adjustment means of the first auditory prosthesis device adjusting the stimulation pulses in the first auditory prosthesis device in accordance with the estimated fundamental frequency corresponding to a first power maximum, and the stimulation pulse adjustment means of the second auditory prosthesis device adjusting the stimulation pulses in the second auditory prosthesis device in accordance with the estimated fundamental frequency corresponding to the second power maximum.

19. A bilateral auditory prosthesis apparatus according to claim 16, wherein the stimulation pulse adjustment means of the first auditory prosthesis device act to apply stimulation pulses to one or more electrodes in the first auditory prosthesis device which correspond to one or more formants of the complex acoustic sounds, and the stimulation pulse adjustment means of the second auditory prosthesis device act to apply stimulation pulses, which are de-correlated with the stimulation pulses applied by the first auditory prosthesis device, to one or more electrodes in the second auditory prosthesis device which corresponds to the same one or more formants.

20 A method of operating an auditory prosthesis device for selectively stimulating electrodes within an auditory prothesis electrode array, the method including:

converting a complex acoustic sound into an electrical signal;

responsive to the electrical signal, generating a temporal pattern of stimulation pulses to selected electrodes within the electrode array, the stimulation pulses being applied to each electrode at an electrode stimulation rate;

deriving an estimate of at least one fundamental frequency of the electrical signal; and

adjusting the stimulation pulses in accordance with the estimated fundamental

frequency.

21. A method according to claim 20, wherein the feature extraction means comprising a plurality of fundamental frequency templates separating the electrical signal into a plurality of different frequency components, each template comprising a first template filter centred on a first frequency and one or more further template filters centred on harmonics of that first frequency, and wherein the step of adjusting the stimulation pulses includes:

comparing output signals from the template filters in each template to determine a matching template passing maximum power compared to the remaining templates, the first frequency of the matching template being used as the estimated fundamental frequency.

22. A method according to claim 21, wherein the step of adjusting the stimulation pulses further includes:

selectively generating stimulation pulses during an electric stimulation period; and

converting the estimated fundamental frequency into the electric stimulation period using a specific conversion function.

23. A method according to claim 22, wherein the specific conversion function performs a first function of setting the longest interval between consecutive pulses in the temporal pattern during the electric stimulation period in accordance with the estimated fundamental frequency.

24. A method according to claim 22, wherein the specific conversion function performs a second function of setting the electric stimulation period in accordance with the estimated fundamental frequency.

25. A method according to claims 23 and 24, wherein the specific conversion function varies between performing the first and second function.

26. A method according to claims 23 and 24, wherein the specific conversion function

preferentially performs the second function when the electrodes to be stimulated in the temporal pattern are physically proximate each other.

27. A method according to claim 22, wherein, in the presence of two or more complex acoustic sounds, the step of deriving an estimate of at least one fundamental frequency of the electrical signal includes:

deriving an estimate of multiple fundamental frequencies from the electrical signal;

using the specific conversion function to convert the multiple fundamental frequencies into a corresponding number of interleaved electric stimulation periods.

28. A method according to claim 20, wherein the step of adjusting the stimulation pulses includes:

modulating the amplitude of the stimulation pulses applied to all or a subset of activated electrodes with a modulation rate corresponding to the estimated fundamental frequency.

29. A method according to claim 20, wherein the step of adjusting the stimulation pulses includes:

processing the output signals from the template filters in the matching template to determine an estimate of one or more formants of the electrical signal.

30. A method according to claim 20, wherein the step of adjusting the stimulation pulses includes:

modulating the amplitude of the stimulation pulses applied to one or more electrodes within the electrode array which correspond to the estimated one or more formants.

31. A method according to claim 20, wherein, when the step of deriving an estimate of at least one fundamental frequency of the electrical signal includes deriving an estimate of multiple fundamental frequencies, each corresponding to a different complex acoustic sound, from the electrical signal, the step of adjusting the stimulation pulses includes:

temporally segregating the amplitude modulation applied to the stimulation pulses for each different complex acoustic sound.

32. A method according to claim 20, wherein the step of adjusting the stimulation pulses includes:

applying a temporal offset to the stimulation pulses applied to those electrodes within the electrode array which correspond to harmonic components or formant frequencies of the acoustic signal with respect to the stimulation pulses applied to other electrodes in the electrode array.

33. A method according to claim 32, wherein the step of adjusting the stimulation pulses further includes:

simultaneously applying stimulation pulses to those electrodes within the electrode array which correspond to the estimated fundamental frequency or formants of the electrical signal.

34. An auditory prosthesis device according to claims 20, wherein the step of adjusting the stimulation pulses further includes:

temporally segregating the stimulation pulses applied to those electrodes within the electrode array which correspond to harmonic components or formant frequencies of the acoustic signal from the stimulation pulses applied to the other electrodes in the electrode array.

35. A method of operating a bilateral auditory prosthesis apparatus including two auditory prosthesis devices according to claims 1, the method including operating each auditory prosthesis device according to claim 20.

36. A method of operating a bilateral auditory prosthesis apparatus according to claim 35, wherein the step of adjusting the stimulation pulses of a first of the auditory prosthesis devices further includes:

determining a matching template passing maximum power compared to the remaining templates in the first auditory prosthesis device;

the method further including:

determining the power passed by the corresponding template in the second auditory prosthesis device and, if less than the power passed by the matching template in the first auditory prosthesis device;

the step of adjusting the stimulation pulses of a first of the auditory prosthesis devices further including:

adjusting the stimulation pulses in the first auditory prosthesis device in accordance with the estimated fundamental frequency.

37. A method of operating a bilateral auditory prosthesis apparatus according to either one of claims 35 or 36, wherein, in the presence of two complex acoustic sounds, the step of adjusting the stimulation pulses of a first of the auditory prosthesis devices includes:

determining matching templates passing power maxima compared to the remaining templates in the first auditory prosthesis device;

adjusting the stimulation pulses in the first auditory prosthesis device in accordance with the estimated fundamental frequency corresponding to a first power maximum;

the step of adjusting the stimulation pulses of a second of the auditory prosthesis devices including:

adjusting the stimulation pulses in the second auditory prosthesis device in accordance with the estimated fundamental frequency corresponding to the second power maximum.

38. A method of operating a bilateral auditory prosthesis apparatus according to claim 35, wherein the step of adjusting the stimulation pulses of a first of the auditory prosthesis devices further includes:

applying stimulation pulses to one or more electrodes in the first auditory prosthesis device which correspond to one or more formants of the complex acoustic sounds;

the step of adjusting the stimulation pulses of a second of the auditory prosthesis devices further including:

applying stimulation pulses, which are de-correlated with the stimulation

pulses applied by the first auditory prosthesis device, to one or more electrodes in the second auditory prosthesis device which corresponds to the same one or more formants.